AQA GCSE CHEMISTRY (HIGHER) · 8462

CHEMISTRY



EXAM QUESTION PACK

4.1.1 ATOMIC STRUCTURE, SYMBOLS, RELATIVE ATOMIC MASS, CHARGE AND ISOTOPES (PACK 4)

SCORE	PERCENTAGE
/202	%

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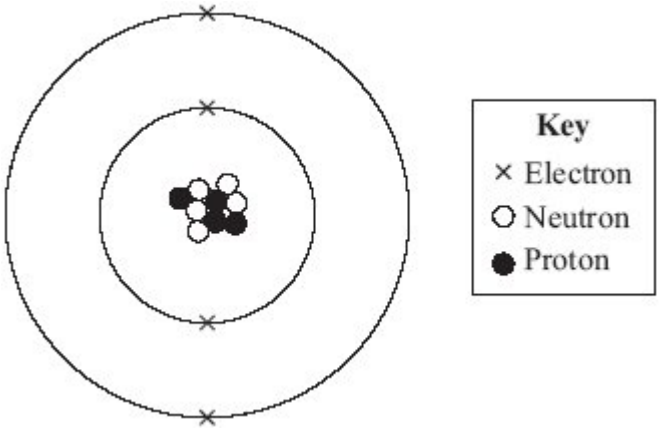
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Q1.

The diagram represents an atom of beryllium.



Use a number from the box to complete each sentence.

4	7	9	12

(a) The atomic number (proton number) of this atom is ☐.

(1)

(b) The mass number of this atom is ☐.

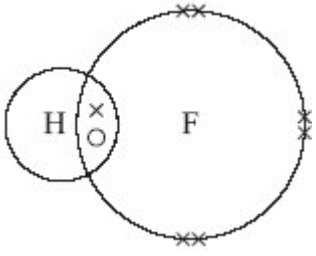
(1)

(Total 2 marks)

Q2.

This question is about fluorine and some of its compounds.

(a) The diagram represents a molecule of hydrogen fluoride.



Draw a ring around the type of bonding that holds the hydrogen and fluorine atoms together in this molecule.

covalent **ionic** **metallic**

(1)

(b) Fluorine is made in industry by the electrolysis of a mixture of potassium fluoride and hydrogen fluoride.

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(i) Use **one** word from the box to complete the sentence.

gas	liquid	solid

To allow electrolysis to take place the mixture of potassium fluoride and hydrogen fluoride must be _____ .

(1)

(ii) The mixture of potassium fluoride and hydrogen fluoride contains fluoride ions (F^-), hydrogen ions (H^+) and potassium ions (K^+).

Use **one** word from the box to complete the sentence.

fluorine	hydrogen	potassium

During electrolysis the element formed at the **positive** electrode is

_____ .

(1)

(c) Fluoride ions are sometimes added to drinking water. It is thought that these ions help to reduce tooth decay.

(i) Tick (✓) **one** question that **cannot** be answered by scientific investigation alone.

Question	Tick (✓)
Do fluoride ions in drinking water reduce tooth decay?	
Are fluoride ions in drinking water harmful to health?	
Should fluoride ions be added to drinking water?	

(1)

(ii) Explain why you have chosen this question.

_____

_____

(1)

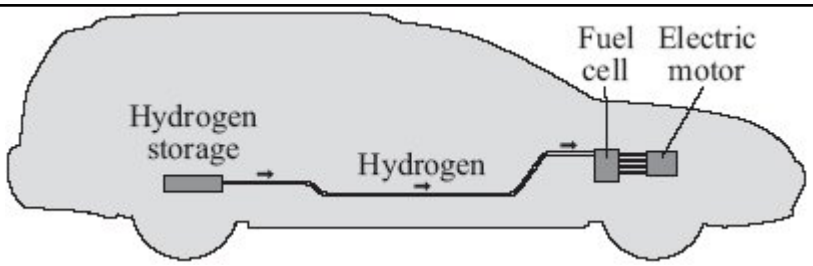
(Total 5 marks)

Q3.

Read the article and then answer the questions that follow.

Hydrogen fuel for cars?

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Hydrogen is an excellent fuel. On combustion it reacts with oxygen from the air to release a large amount of energy. The only product of combustion is water which does not cause pollution. Hydrogen gas can be stored under pressure in a cylinder but a leak of the gas could cause an explosion.

It has been found that lithium nitride can absorb and then release large volumes of hydrogen. Hydrogen stored in lithium nitride will not explode.

The problem is that the rate at which hydrogen is absorbed and then released from normal sized particles of lithium nitride is slow.

Recently scientists have made 'nanosized' particles of lithium nitride. The 'nanosized' particles have the advantage that they absorb and release the hydrogen much faster when needed in the fuel cell.

(a) Use information from the article to help you to answer these questions.

(i) Give **two** reasons why hydrogen is an excellent fuel.

_____

_____

_____

_____

(2)

(ii) Hydrogen stored in lithium nitride is safer in an accident than a cylinder full of hydrogen gas.

State why.

_____

_____

(1)

(iii) What is the advantage of using 'nanosized' particles of lithium nitride instead of normal sized particles for storing hydrogen?

_____

_____

(1)

(b) Lithium nitride is an ionic compound that contains lithium ions (Li^+) and nitride ions (N^{3-}).

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(i) The periodic table on the Data Sheet may help you to answer this question.

Which diagram, **A**, **B** or **C**, represents the electronic structure of a lithium atom?
Write your answer in the box.

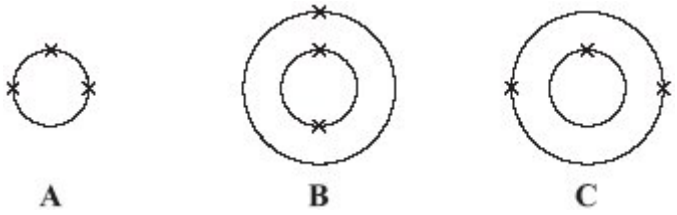


Diagram ☐

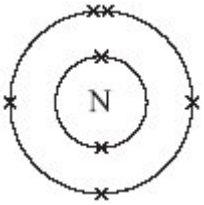
(1)

(ii) Tick (✓) the statement which describes how a lithium atom (Li) changes into a lithium ion (Li^+).

Statement	Tick (✓)
A lithium atom loses a neutron.	
A lithium atom loses an electron.	
A lithium atom loses a proton.	

(1)

(iii) The diagram shows the electronic structure of a nitrogen atom.



Which diagram, **A**, **B** or **C**, represents the electronic structure of a nitride ion (N^{3-})?
Write your answer in the box.

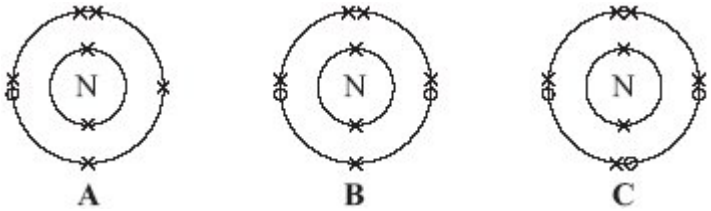


Diagram ☐

(1)

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(c) The equation for the reaction of lithium nitride with hydrogen is:

$$Li_3N + 2H_2 \rightleftharpoons LiNH_2 + 2LiH$$

What does the symbol $\rightleftharpoons$ mean?

Draw a ring around your answer.

reversible reaction **endothermic reaction** **neutralisation**

(1)

(d) Draw a ring around the correct answer in each box to complete the sentences.

(i) 'Nanosized' particles of lithium nitride will be

much larger
a little larger
much smaller

than normal sized particles of lithium nitride.

(1)

(ii) One of the reasons why 'nanosized' particles have different properties from normal sized particles is that they have a greater

density
mass
surface area

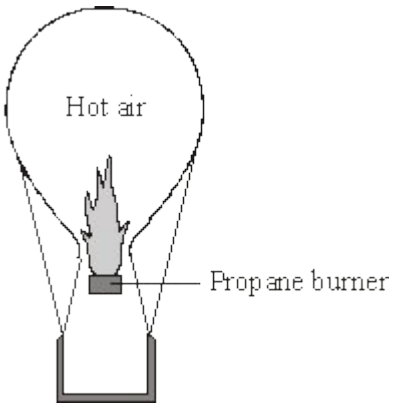
than normal sized particles of lithium nitride.

(1)

(Total 10 marks)

Q4.

Hot air balloons burn hydrocarbons to heat the air.



(a) The hot air contains these gases: nitrogen, N_2
oxygen, O_2
argon, Ar
carbon dioxide, CO_2
water vapour, H_2O

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(i) Argon is an *element*.

What is an *element*?

_____

_____

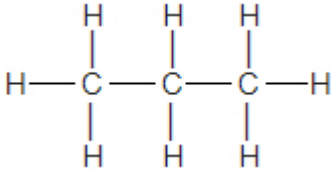
(1)

(ii) Name **one** other gas in the hot air that is also an element.

_____

(1)

(b) Propane, C_3H_8, can be represented as:



Use the correct words from the box to complete the sentences.

bond	**carbon**	**compound**	**element**	**mixture**

(i) Propane is a _____ and is made up of atoms of hydrogen and _____

(2)

(ii) Each line between the atoms in propane represents a chemical _____

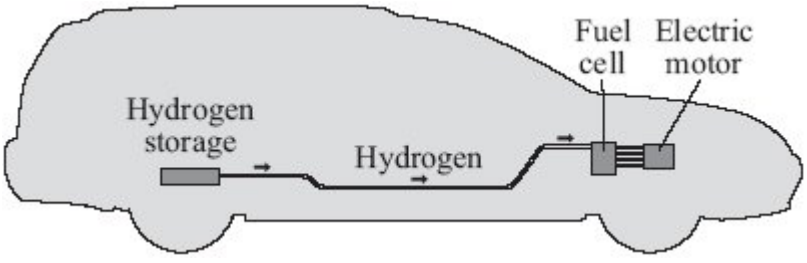
(1)

(Total 5 marks)

Q5.

Read the article and then answer the questions that follow.

Hydrogen fuel for cars?



Hydrogen is an excellent fuel. It can be made by the electrolysis of potassium hydroxide solution.

Hydrogen gas can be stored under pressure in a cylinder but a leak of the gas could cause an explosion.

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It has been found that lithium nitride can absorb and then release large volumes of hydrogen. A chemical reaction takes place between the hydrogen and the lithium nitride. The hydrogen is held in the resulting compounds by chemical bonds.

The problem is that the rate at which hydrogen is absorbed and then released from normal sized particles of lithium nitride is slow.

Recently scientists have made 'nanosized' particles of lithium nitride. These particles absorb hydrogen in the same way as normal sized lithium nitride particles. The 'nanosized' particles have the advantage that they absorb and release the hydrogen much faster when needed in the fuel cell.

It is hoped that 'nanosized' particles of lithium nitride may provide a safe method of storing hydrogen in the future.

(a) Hydrogen is produced at the negative electrode during the electrolysis of potassium hydroxide solution.

(i) Why are hydrogen ions attracted to the negative electrode?

_____

_____

_____

(1)

(ii) Potassium ions are also attracted to the negative electrode.

Explain why hydrogen gas is formed but not potassium.

_____

_____

_____

(1)

(b) Lithium nitride is made by reacting lithium with nitrogen.

Balance the equation for this reaction.

_____ $Li + N_2 \rightarrow$ _____ Li_3N

(1)

(c) (i) The equation for the reaction of lithium nitride with hydrogen is:

$$Li_3N + 2H_2 \rightleftharpoons LiNH_2 + 2LiH$$

What feature of this reaction allows the hydrogen to be released?

_____

_____

(1)

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(ii) Hydrogen stored in a fuel tank filled with lithium nitride would be safer in an accident than a cylinder full of hydrogen.

Suggest and explain why.

_____

_____

_____

_____

_____

(2)

(d) Lithium nitride is an ionic compound which contains lithium ions (Li^+) and nitride ions (N^{3-}).

(i) The formation of a lithium ion from a lithium atom is an oxidation reaction.

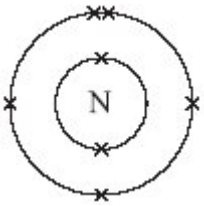
Explain why.

_____

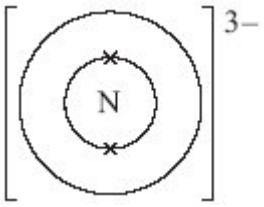
_____

(1)

(ii) The diagram shows the electronic structure of a nitrogen atom.



Complete the diagram below to show the electronic structure of a nitride ion (N^{3-}).



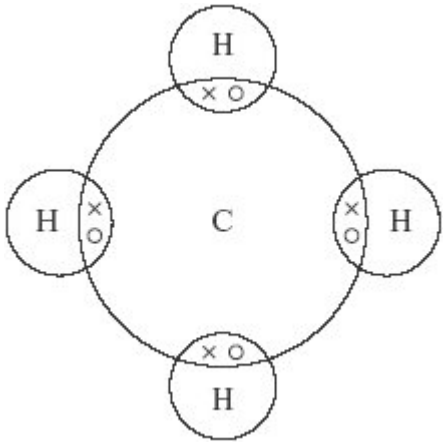
(1)

(Total 8 marks)

Q6.

The diagram represents a particle of methane.

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(a) What is the formula of methane? _____

(1)

(b) Choose a word from the box to answer the question.

atom	**ion**	**molecule**

Which of the words best describes the methane particle shown in the diagram?

_____

(1)

(c) Choose a word from the box to answer the question.

covalent	**ionic**	**metallic**

What is the type of bonding shown in the diagram?

_____

(1)

(Total 3 marks)

Q7.

Distress flares are used to attract attention in an emergency.



Flares often contain magnesium. Magnesium burns to form magnesium oxide.

(a) The distress flare burns with a bright flame because the reaction is very *exothermic*.

Complete the following sentence using the correct words from the box.

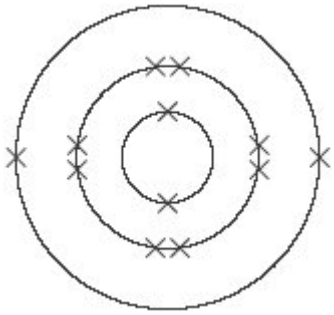
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gives out heat	stores heat	takes in heat

An *exothermic* reaction is one which _____ .

(1)

(b) The diagram shows the electronic structure of a magnesium atom.
The atomic (proton) number of magnesium is 12.



Magnesium atom

The atomic (proton) number of oxygen is 8.

Which diagram, **A**, **B**, **C** or **D**, shows the electronic structure of an oxygen atom?

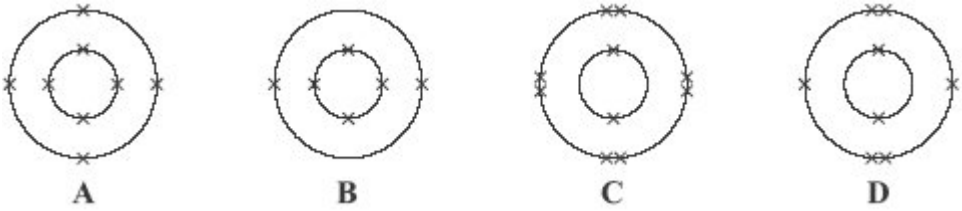
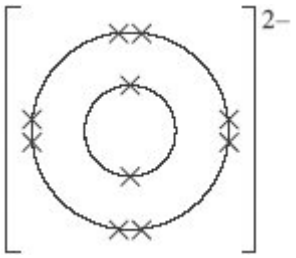


Diagram _____

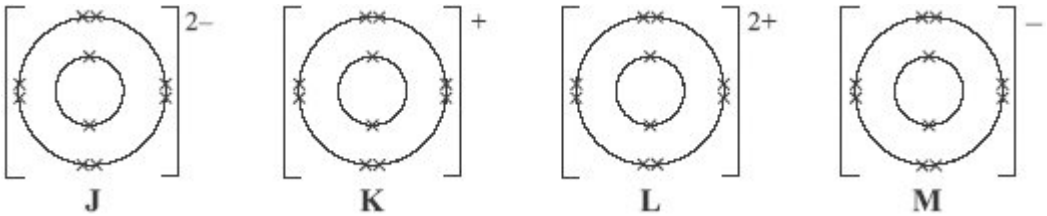
(1)

(c) Magnesium ions and oxide ions are formed when magnesium reacts with oxygen.
The diagram shows the electronic structure of an oxide ion.



Oxide ion

Which diagram, **J**, **K**, **L** or **M**, shows the electronic structure of a magnesium ion?



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Diagram _____

(1)

(d) Indigestion tablets can be made from magnesium oxide. The magnesium oxide neutralises some of the hydrochloric acid in the stomach.

Draw a ring around the name of the salt formed when magnesium oxide reacts with hydrochloric acid.

magnesium chloride **magnesium hydroxide** **magnesium sulfate**

(1)

(Total 4 marks)

Q8.

(a) A chemist was asked to identify a nitrogen compound. The chemist carried out an experiment to find the relative formula mass (M_r) of the compound.

The M_r of the compound was **44**.

Relative atomic masses: N = 14, O = 16

Draw a ring around the formula of the compound.

NO **NO_2** **N_2O_4** **N_2O**

(1)

(b) Potassium nitrate is another nitrogen compound. It is used in fertilisers. It has the formula **KNO_3**.

The **M_r** of potassium nitrate is **101**.

Calculate the percentage of **nitrogen** by mass in potassium nitrate.

Relative atomic mass: N = 14.

_____

_____

Percentage of nitrogen = _____ %

(2)

(Total 3 marks)

Q9.

The *electrolysis* of sodium chloride solution produces useful substances.

(a) Explain the meaning of *electrolysis*.

_____

_____

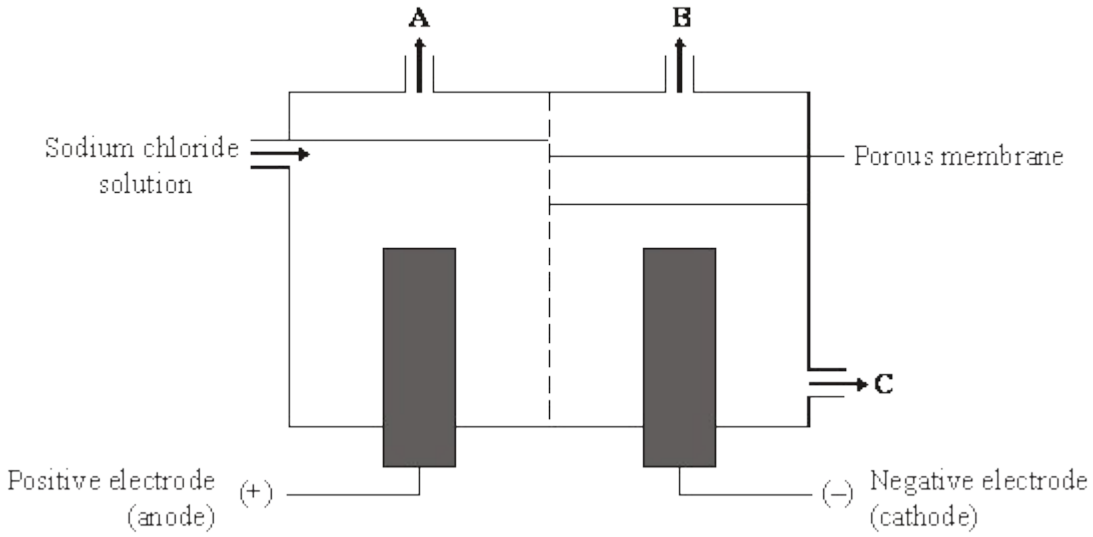
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_____

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(2)

(b) The diagram shows an apparatus used for the electrolysis of sodium chloride solution.



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The electrolysis produces two gases, chlorine and Gas **A.**

Name Gas **A** _____

(1)

(c) The electrodes used in this process can be made of graphite. Explain why graphite conducts electricity.

_____

_____

_____

_____

(2)

(Total 5 marks)

Q10.

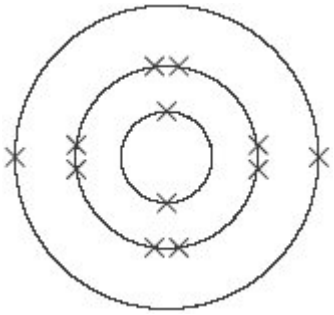
(a) Write a balanced symbol equation for the reaction between magnesium (Mg) and oxygen (O_2) to form magnesium oxide (MgO).

_____

(1)

(b) The diagram shows the electronic structure of a magnesium atom.
The atomic (proton) number of magnesium is 12.

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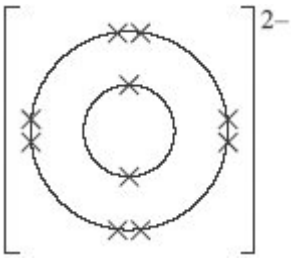
Magnesium atom

Draw a similar diagram to show the electronic structure of an oxygen atom.
The atomic (proton) number of oxygen is 8.

(1)

(c) Magnesium ions and oxide ions are formed when magnesium reacts with oxygen.

The diagram shows the electronic structure of an oxide ion.



Oxide ion

Draw a similar diagram to show the electronic structure of a magnesium ion.

(1)

(d) Magnesium oxide is a white solid with a high melting point.

Explain how the ions are held together in solid magnesium oxide.

_____

_____

_____

_____

(2)

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(e) Indigestion tablets can be made from magnesium oxide. The magnesium oxide neutralises some of the hydrochloric acid in the stomach.

Complete the word equation for the reaction between magnesium oxide and hydrochloric acid.

hydrochloric acid + magnesium oxide → _____ + water.

(1)

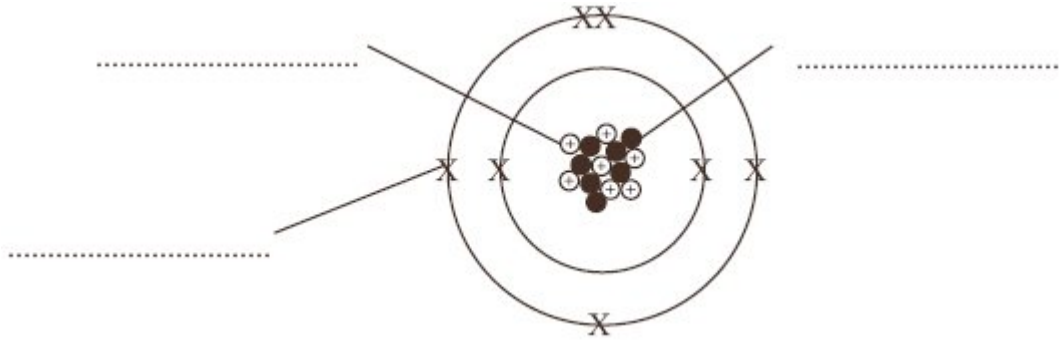
(Total 6 marks)

Q11.

(a) The diagram represents an atom of nitrogen.

(i) Use words from the box to label the diagram.

electron	neutron	nucleus	proton



(2)

(ii) Draw a ring around the mass number of this atom.

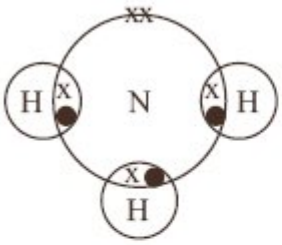
5 **7** **14** **21**

(1)

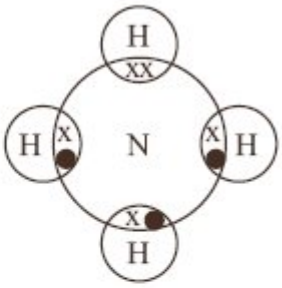
(b) Nitrogen can react with hydrogen to make ammonia, NH_3 .

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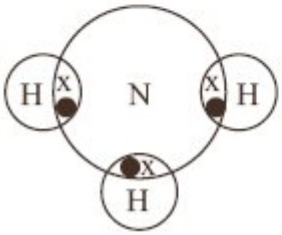
A



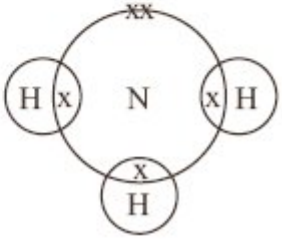
B



C



D



Which diagram, **A**, **B**, **C** or **D**, best represents an ammonia molecule? ☐

(1)

(Total 4 marks)

Q12.

(a) Read the article about the use of nanoparticles in sun creams.

Sun creams

Many sun creams use nanoparticles. These sun creams are very good at absorbing radiation, especially ultraviolet radiation. Owing to the particle size, the sun creams spread more easily, cover better and save money because you use less. The new sun creams are also transparent, unlike traditional sun creams which are white. The use of nanoparticles is so successful that they are now used in more than 300 sun cream products.

Some sun creams contain nanoparticles of titanium oxide. Normal-sized particles of titanium oxide are safe to put on the skin.

It is thought that nanoparticles can pass through the skin and travel around the body more easily than normal-sized particles. It is also thought that nanoparticles might be toxic to some types of cell, such as skin, bone, brain and liver cells.

(i) How is the size of nanoparticles different from normal-sized particles of titanium oxide?

_____

(1)

(ii) Suggest how the size of nanoparticles might help them to enter the body more easily.

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_____

_____

(1)

(b) Give **two** advantages of using nanoparticles in sun creams.

1. _____

_____

2. _____

_____

(2)

(c) Why might nanoparticles be dangerous inside the body?

_____

_____

(1)

(Total 5 marks)

Q13.

Toothpastes often contain fluoride ions to help protect teeth from attack by bacteria.



Some toothpastes contain tin(II) fluoride.

This compound has the formula SnF_2 .

(a) Calculate the relative formula mass (M_r) of SnF_2.

Relative atomic masses: F = 19; Sn = 119

_____

_____

_____

_____

Relative formula mass (M_r) = _____

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(2)

(b) Calculate the percentage by mass of fluorine in SnF_2.

_____

_____

_____

_____

Percentage by mass of fluorine = _____ %

(2)

(c) A tube of toothpaste contains 1.2 g of SnF_2.

Calculate the mass of fluorine in this tube of toothpaste.

_____

_____

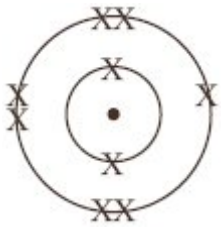
_____

_____

Mass of fluorine = _____ g

(1)

(d) The diagram represents the electron arrangement of a fluorine atom.



Explain how a fluorine atom can change into a fluoride ion, F^-.

_____

_____

_____

_____

(2)

(Total 7 marks)

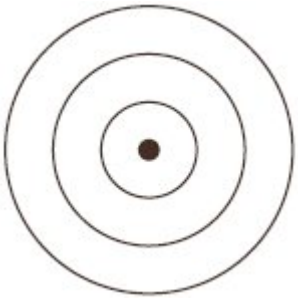
Q14.

Aluminium is a useful metal.

(a) The atomic number (proton number) of aluminium is 13.

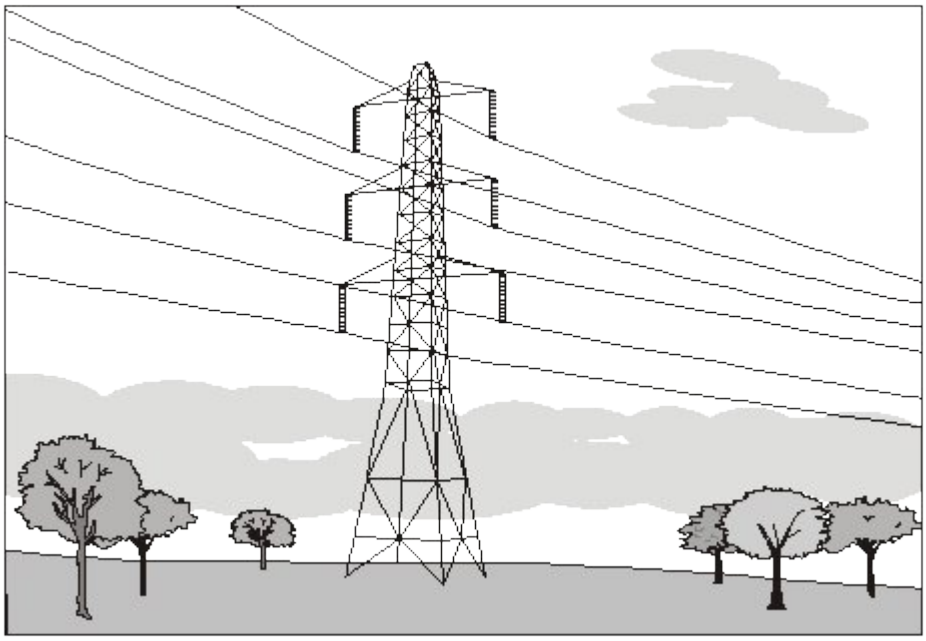
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Complete the diagram to show the electronic structure of an aluminium atom.
Use crosses (x) to represent the electrons.



(1)

(b) Aluminium is used as the electrical conductor for overhead power cables.



Explain why metals are good conductors of electricity.

_____

_____

_____

_____

(2)

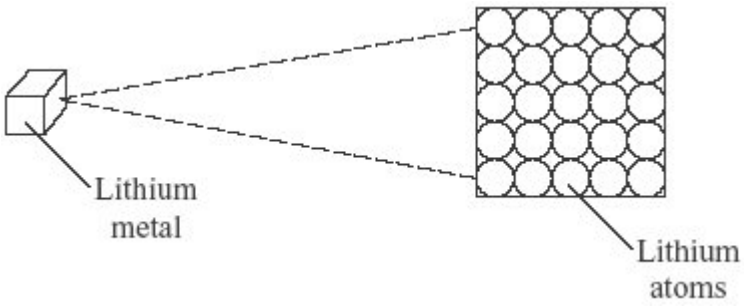
(Total 3 marks)

Q15.

Lithium metal is used in alkaline batteries.

(a) The diagram shows the atoms in lithium metal.

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Why is lithium metal described as an element?

_____

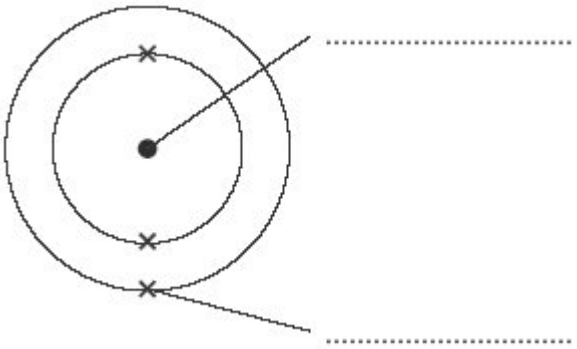
_____

(1)

(b) The diagram below represents a lithium atom.

Choose words from the box to label parts of the atom.

bond	**electron**	**molecule**	**nucleus**



(2)

(Total 3 marks)

Q16.

John Dalton wrote these statements in 1808.

- "All substances are made of a vast number of extremely small particles called atoms."
- "Every particle of water is like every other particle of water, every particle of hydrogen is like every other particle of hydrogen, etc."

(a) "Every particle of water is like every other particle of water." Use Dalton's ideas and your knowledge of water to explain why.

_____

_____

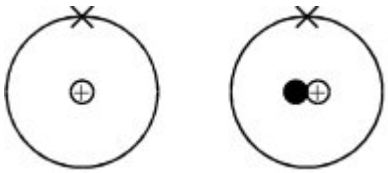
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_____

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(2)

(b) Dalton thought that all atoms of an element are exactly the same. We now know that it is possible to have atoms of the same element but with different mass numbers. The diagrams represent two atoms of hydrogen.



Atom **A** Atom **B**

State, in terms of particles, how these two atoms are different.

_____

_____

(1)

(Total 3 marks)

Q17.

Iron ore contains iron oxide.

(i) Calculate the relative formula mass of iron oxide, Fe_2O_3.

Relative atomic masses: O = 16; Fe = 56.

_____

_____

Answer = _____

(2)

(ii) Calculate the percentage by mass of iron in iron oxide.

_____

Percentage of iron = _____ %

(2)

(iii) Calculate the mass of iron that could be extracted from 1000 kg of iron oxide.

Use your answer to part (c) (ii) to help you with this calculation.

_____

Mass of iron = _____ kg

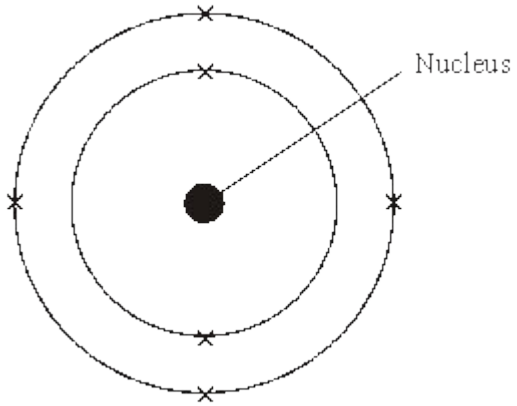
(1)

(Total 5 marks)

Q18.

The diagram represents the electronic structure of an atom of an element.

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The periodic table on the Data Sheet may help you with this question.

(a) Name this element.

_____

(1)

(b) Complete this sentence.

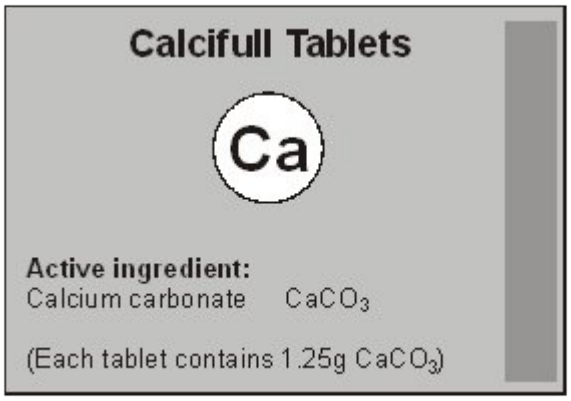
The nucleus of an atom contains neutrons and _____ .

(1)

(Total 2 marks)

Q19.

Calcium carbonate tablets are used to treat people with calcium deficiency.



(a) Calculate the relative formula mass (M_r) of calcium carbonate.

Relative atomic masses: C = 12; O = 16; Ca = 40.

_____

_____

Relative formula mass = _____

(2)

(b) Calculate the percentage of calcium in calcium carbonate, $CaCO_3$.

_____

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_____

Percentage of calcium = _____ %

(2)

(c) Calculate the mass of calcium in each tablet.

_____

_____

Mass of calcium = _____ g

(2)

(d) An unwanted side effect of this medicine is that it can cause the patient to have 'wind' (too much gas in the intestine).

The equation below represents the reaction between calcium carbonate and hydrochloric acid (the acid present in the stomach).

$$CaCO_3\ (s) + 2HCl\ (aq) \rightarrow CaCl_2\ (aq) + H_2O\ (l) + CO_2\ (g)$$

Suggest why the patient may suffer from 'wind'.

_____

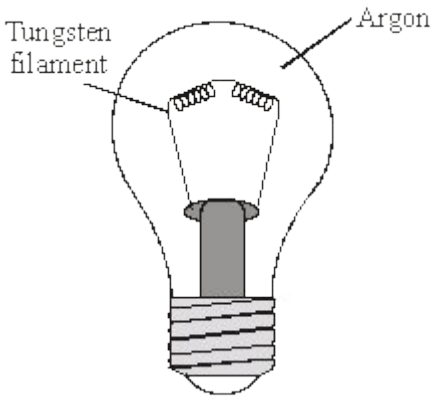
_____

(1)

(Total 7 marks)

Q20.

The diagram shows an electric light bulb.



When electricity is passed through the tungsten filament it gets very hot and gives out light.

(a) What reaction would take place if the hot tungsten was surrounded by air?

_____

_____

_____

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(1)

(b) State why argon is used in the light bulb. Explain your answer in terms of the electronic structure of an argon atom.

_____

_____

_____

_____

_____

_____

(3)

(Total 4 marks)

Q21.

Silicon is an important element used in the electronics industry.

(a) Silicon can be made by heating a mixture of sand (silicon dioxide) with magnesium powder.

The equation for this reaction is shown below.

$$SiO_2\ (s) + 2Mg\ (s) \rightarrow 2MgO\ (s) + Si\ (s)$$

Calculate the mass of silicon dioxide needed to make 1 g of silicon.

Relative atomic masses: O = 16; Si = 28

_____

_____

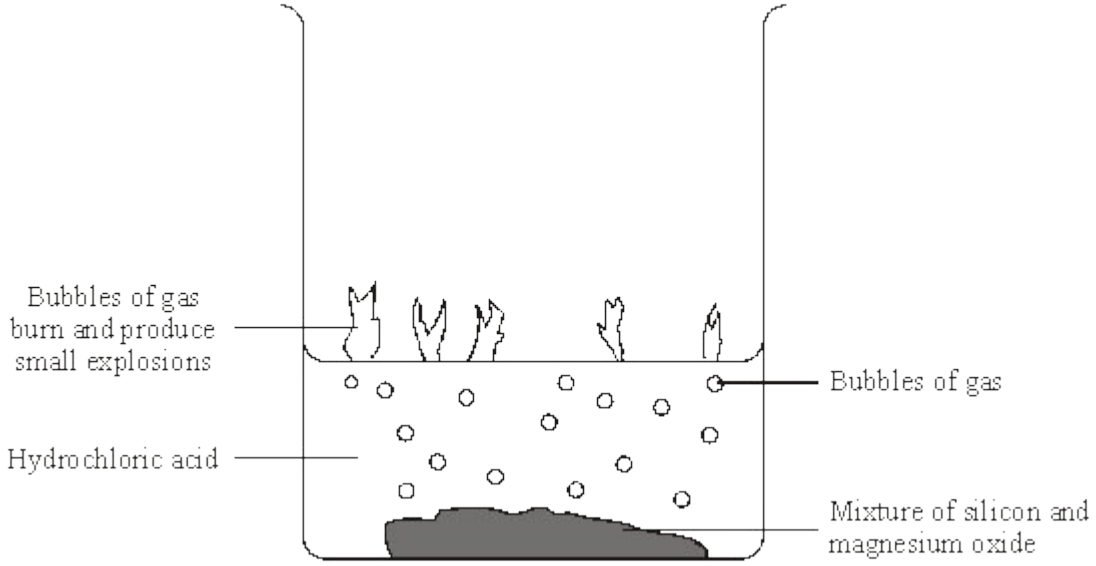
_____

Mass = _____g

(3)

(b) The resulting mixture of magnesium oxide and silicon is added to a beaker containing hydrochloric acid. The silicon is then filtered from the solution.

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(i) The magnesium oxide reacts with the hydrochloric acid and forms magnesium chloride ($MgCl_2$) solution and water.

magnesium oxide + hydrochloric acid → magnesium chloride solution + water

Write a balanced symbol equation for this reaction, including state symbols.

_____

(2)

(ii) The gases produced are a mixture of several silicon hydrides.

One of the gases produced in the reaction is the silicon hydride with the formula SiH_4. The structure of this molecule is similar to methane, CH_4.

Draw a diagram to show the bonding in a molecule of SiH_4. Represent the electrons as dots and crosses and only show the outer shell (energy level) electrons.

(1)

(iii) A sample of a different silicon hydride was found to contain 1.4 g of silicon and 0.15 g of hydrogen.

Calculate the formula of this silicon hydride. You must show all your working to gain full marks.

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Relative atomic masses: H = 1; Si = 28

_____

_____

_____

_____

_____

_____

_____

(4)

(iv) The silicon hydrides react immediately they come into contact with oxygen in the air. They burst into flames with a small explosion and give out energy.

Which letter, **A** to **H**, best describes this reaction?

Energy involved in breaking and forming bonds	Activation energy	Rate of reaction	Letter
The energy released from forming new bonds is greater than the energy needed to break existing bonds	high	fast	**A**
		slow	**B**
	low	fast	**C**
		slow	**D**
The energy needed to break existing bonds is greater than the energy released from forming new bonds	high	fast	**E**
		slow	**F**
	low	fast	**G**
		slow	**H**

Letter _____

(1)

(c) The structure of silicon is similar to the structure of diamond.

Describe the structure of silicon and explain why it has a high melting point. You may draw a diagram if this helps.

_____

_____

_____

_____

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_____

_____

_____

_____

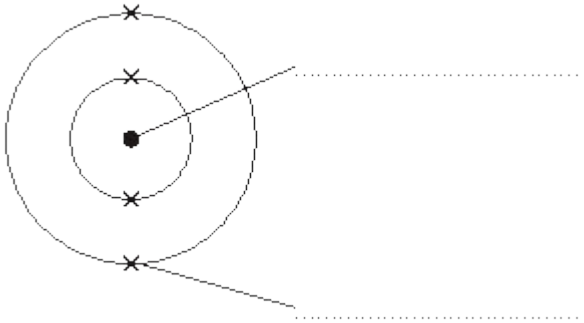
(4)

(Total 15 marks)

Q22.

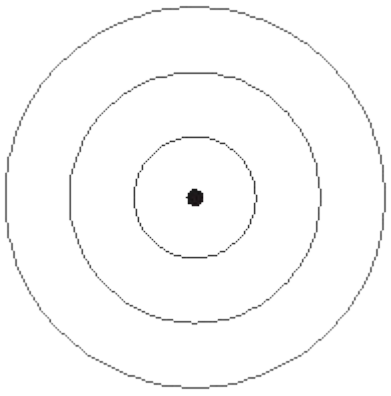
(a) The diagram represents an atom of beryllium. Use words from the box to label the diagram.

electron	**ion**	**isotope**	**molecule**	**nucleus**



(2)

(b) Use crosses (*x*) to complete the diagram to show the electronic structure of a magnesium atom. The atomic (proton) number of magnesium is 12.



(2)

(Total 4 marks)

Q23.

A student investigated some instant soup.

(a) Instant soup contains a food additive which has the formula:

NaH_2PO_4

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Give the names of all the elements in this compound.

The periodic table on the Data Sheet may help you to answer this question.

_____

_____

(2)

(b) The student investigated the reaction which takes place when soup powder is added to cold water.

The student thought that the reaction might be *exothermic.*

(i) What is meant by the term *exothermic* reaction?

_____

_____

(2)

(ii) Describe an experiment that the student could do to prove that this reaction is exothermic.

To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.

_____

_____

_____

_____

_____

_____

_____

_____

(4)

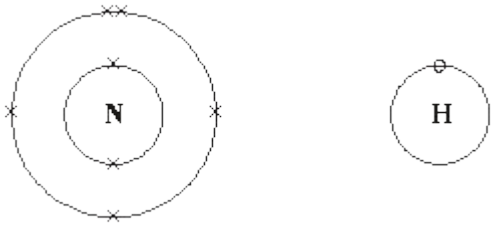
(Total 8 marks)

Q24.

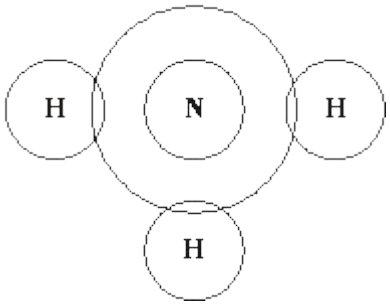
Ammonia (NH_3) is an important chemical which is used to make fertilisers. Ammonia is made from nitrogen and hydrogen,

(a) The diagrams represent the electron arrangements in atoms of nitrogen and hydrogen.

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Complete the diagram showing the arrangement of electrons in a molecule of ammonia.



(1)

(b) Name the type of bonding which holds the nitrogen and hydrogen atoms together in an ammonia molecule.

_____

(1)

(Total 2 marks)

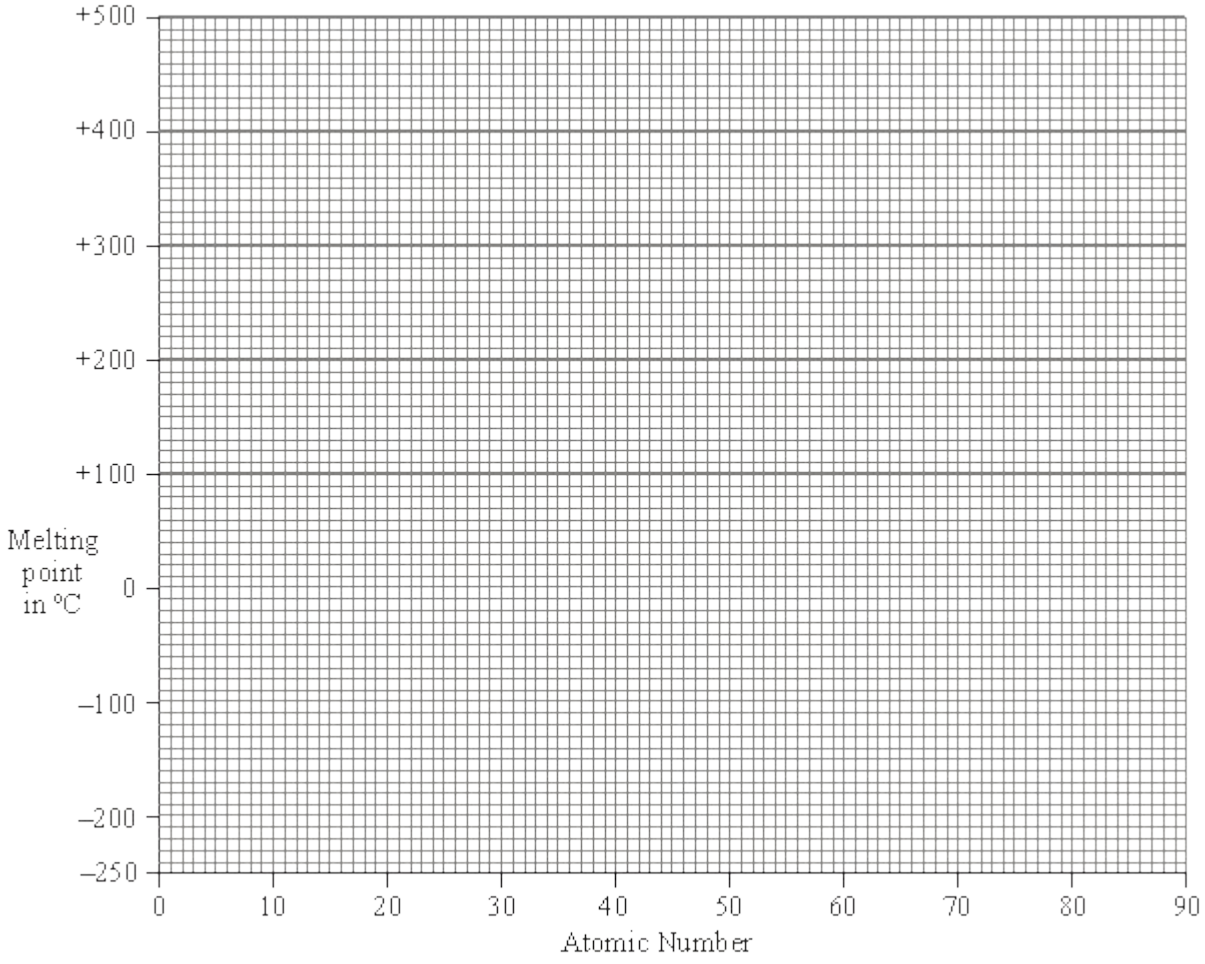
Q25.

(a) The table gives the melting points of some of the elements of Group 7.

Element	Atomic number	Melting point in ºC
Fluorine	9	–220
Chlorine	17	–101
Bromine	35	–7
Iodine	53	114
Astatine	85	?

(i) Plot a graph of the melting point against atomic number.

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Draw a line of best fit.
Extend your line to estimate a value for the melting point of astatine.

(2)

(ii) Estimate the melting point of astatine. _____ °C

(1)

(iii) Which of the Group 7 elements are solids at 20 °C?

_____

(1)

(b) (i) Draw a diagram to show the arrangement of electrons in an atom of fluorine.

(1)

(ii) The elements of Group 7 have similar chemical properties.

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Explain, in terms of electrons, why they have similar chemical properties.

_____

_____

(1)

(c) Xenon is a very unreactive element.

(i) Explain, in terms of electrons, why xenon is so unreactive.

_____

_____

_____

_____

(2)

(ii) Fluorine reacts with xenon but iodine does not.

Explain, in terms of atomic structure, why fluorine is more reactive than iodine.

_____

_____

_____

_____

_____

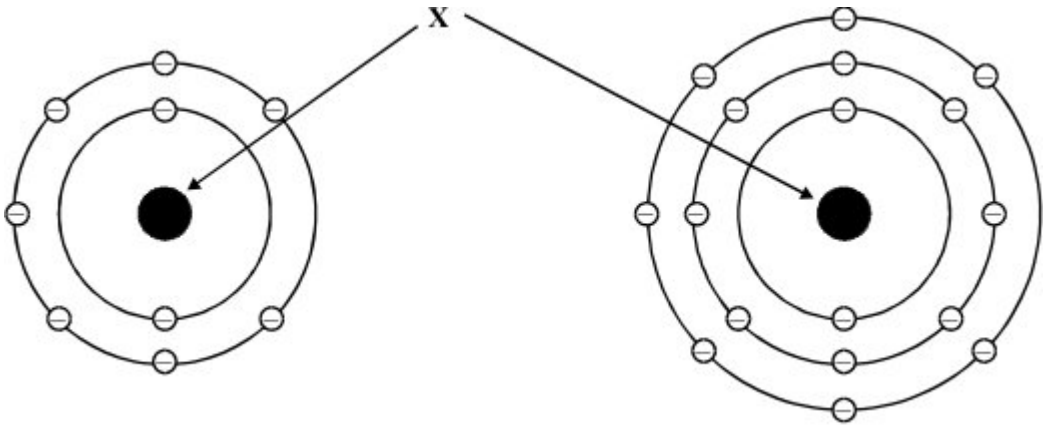
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(3)

(Total 11 marks)

Q26.

The diagrams show the electronic arrangement of the atoms of two elements.



(i) Name the part of the atoms labelled **X**.

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_____

(1)

(ii) Why are these two elements in the same group of the Periodic Table?

_____

_____

(1)

(Total 2 marks)

Q27.

Fluorine is more reactive than chlorine. Fluorine reacts with most elements in the Periodic Table. However, fluorine does not react with argon.

Atomic numbers: F 9; Cl 17; Ar 18.

(a) To which group of the Periodic Table do fluorine and chlorine belong?

_____

(1)

(b) (i) Give **one** use for argon.

_____

(1)

(ii) Explain why the noble gas argon is unreactive.

_____

_____

_____

_____

(2)

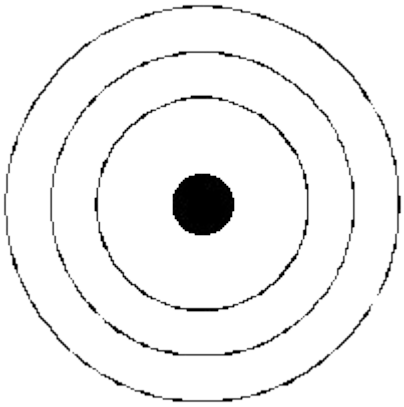
(c) (i) Give **one** use for chlorine.

_____

(1)

(ii) Draw the electron arrangement of a chlorine atom.

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(2)

(iii) Explain why fluorine is more reactive than chlorine.

_____

_____

_____

_____

_____

_____

_____

_____

(3)

(Total 10 marks)

Q28.

There is molten rock below the Earth's solid outer crust. The rock remains molten because the radioactive decay of isotopes such as uranium, thorium and potassium releases heat energy.

(i) Explain how this released heat energy is thought to cause the recycling of rocks.

_____

_____

_____

_____

_____

_____

_____

_____

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(4)

(ii) Two *isotopes* of potassium are shown.

$^{39}_{19}K$ $^{49}_{19}K$

Explain what is meant by *isotopes.* You must include numbers of electrons, neutrons and protons in your explanation.

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(Total 8 marks)

Q29.

The chemical equation for the formation of iron is:

$Fe_2O_3(s) + 3CO(g) \rightarrow 2Fe(s) + 3CO_2(g)$

Calculate the relative formula mass of iron oxide, Fe_2O_3.

Relative atomic masses: O 16; Fe 56.

_____

_____

_____

Relative formula mass Fe_2O_3 = _____

(Total 2 marks)

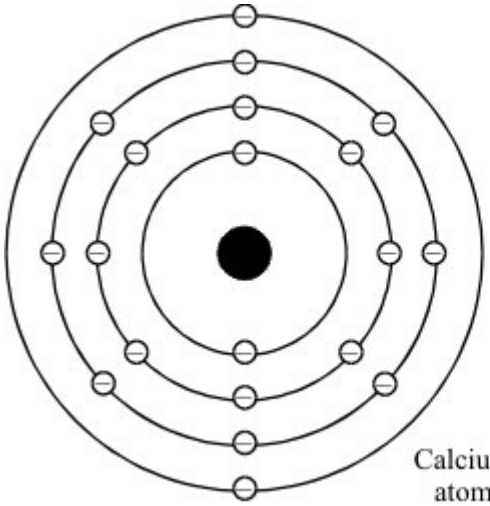
Q30.

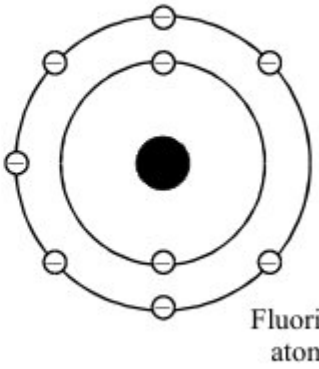
Uranium metal can be produced by reacting uranium hexafluoride with calcium.

$UF_6 + 3Ca \rightarrow 3CaF_2 + U$

(a) Describe how calcium and fluorine bond together to form calcium fluoride. The electron arrangement of each atom is shown.

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_____

_____

_____

_____

_____

(5)

(b) Uranium has two main isotopes, $^{235}_{92}U$ and $^{238}_{92}U$. Use these as examples to explain what is meant by the word isotope.

_____

_____

_____

_____

_____

(4)

(c) At the start of a reaction there was 174.5 g of uranium hexafluoride, UF_6.

Relative atomic masses: F 19; U 235

(i) Calculate the relative formula mass of uranium hexafluoride, UF_6.

_____

_____

_____

Relative formula mass UF_6 = _____ g

(1)

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(ii) Calculate the mass of uranium that would be produced from 134.5 g of uranium hexafluoride.

_____

_____

_____

_____

_____

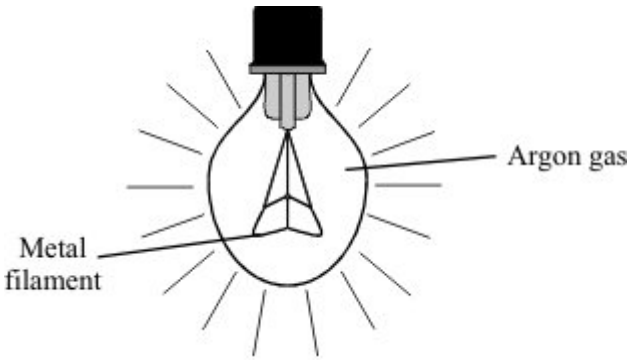
Mass of uranium = _____ g

(2)

(Total 12 marks)

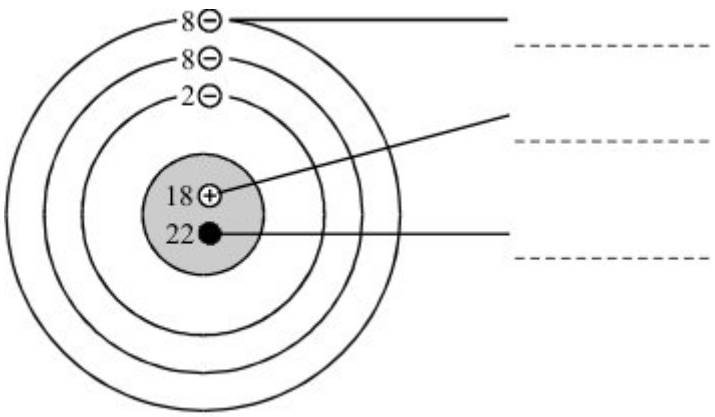
Q31.

The diagram shows a light bulb.



(a) (i) An argon atom has the structure shown. Use the words in the box to label the particles in the atom. Each word should only be used **once.**

electron	neutron	proton



(2)

(ii) Argon is unreactive. Why?

_____

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_____

(1)

(b) Oxygen would **not** be a suitable gas to use in a light bulb. Explain why.

_____

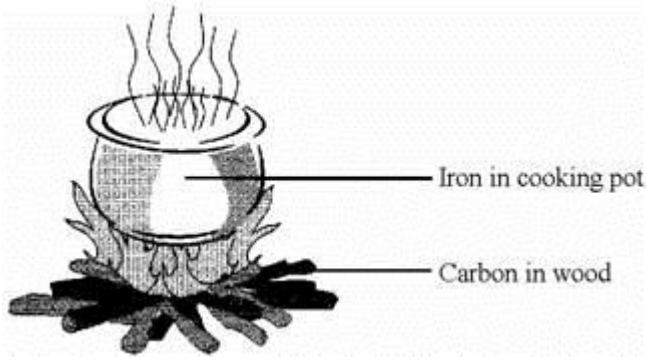
_____

(2)

(Total 5 marks)

Q32.

The uses of *elements* depend on their properties.



(a) Carbon and iron are both *elements.* What is an *element?*

_____

_____

(1)

(b) Complete the sentences by crossing out the words that are wrong. The first one has been done for you.

~~Non-Metals~~	Metals	can be hammered into shape.
Non-Metals	Metals	often have low melting point.
Non-Metals	Metals	are good conductors of heat.

(2)

(c) In the box are the names of three metals.

copper	iron	sodium

Which **one** of these is **not** a good metal for making the cooking pot? Give a reason for your answer.

Metal _____

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Reason _____

_____

_____

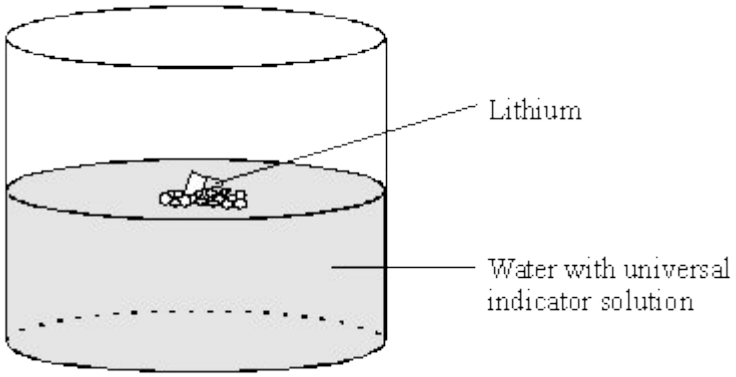
(2)

(Total 5 marks)

Q33.

Lithium is a very reactive metal.

(a) Lithium reacts with cold water.



(i) Which **physical** property of lithium is seen during this reaction?

_____

(1)

(ii) Which **chemical** property of lithium will be shown by the universal indicator?

_____

(1)

(b) Complete the sentence by writing in the missing numbers.

Lithium has an atomic number of 3 and a mass number of 7.

This means that an atom of lithium has _____ protons _____ electrons

and _____ neutrons.

(3)

(Total 5 marks)

Q34.

This question is about the Periodic Table.

(a) Dimitri Mendeleev was a Russian scientist who, in 1869, helped to develop the Periodic Table. He made his table with the known elements arranged in order of increasing atomic mass. He started new rows so that elements with similar chemical properties would be in the same column. Mendeleev sometimes had to leave gaps in his table.

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(i) Complete the sentences.

The Periodic Table is now the arrangement of the elements in order

of increasing atomic _____ . The rows are called _____

and the columns are called _____ .

(3)

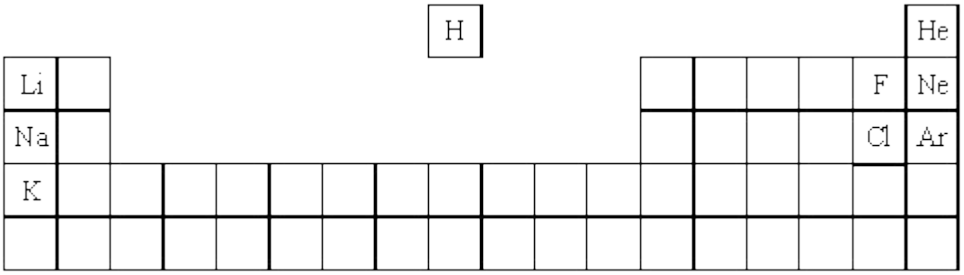
(ii) Suggest why Mendeleev had to leave gaps in his table.

_____

_____

(1)

(b) This section of the Periodic Table shows the positions of some elements.

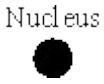


(i) Give the chemical symbol for **one** of the noble gases.

_____

(1)

(ii) Draw the arrangement of electrons around the nucleus for the noble gas that you chose in (i).



(1)

(iii) Why do the electron arrangements of lithium, sodium and potassium make them react in a similar way?

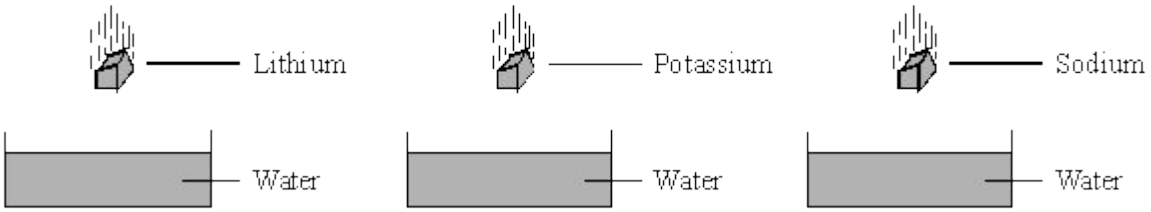
_____

_____

(1)

(iv) Small pieces of lithium, potassium and sodium are added to water.

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What is the order of reactivity for these three metals? Put the most reactive metal first.

_____

_____

(1)

(v) Complete and balance the chemical equation for the reaction of sodium with water.

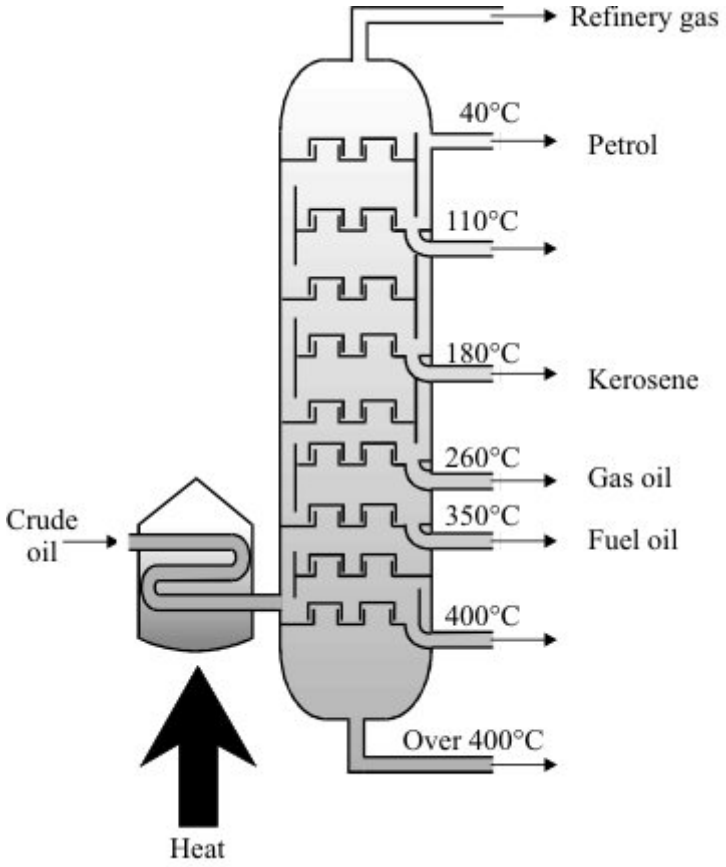
$2Na(s) + 2H_2O(l) \rightarrow$ _____NaOH(aq) + _____(g)

(2)

(Total 10 marks)

Q35.

To make crude oil more useful it is separated into different fractions.



(a) Complete the gaps in the following sentences.

Crude oil is separated into different fractions by a process called _____

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_____ . Each fraction has a different _____ .

(2)

(b) Each fraction is a mixture of compounds. Most of these compounds are hydrocarbons, made up of the elements hydrogen and carbon.

(i) Explain the difference between a mixture and a compound.

_____

_____

_____

(2)

(ii) Explain the difference between a compound and an element.

_____

_____

_____

(2)

(Total 6 marks)

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